Nat. Volatiles & Essent. Oils, 2022; 9(1): 1393-1402

NVEO
Natural Volatiles & Essential Oils

Effect Of Bacterial Fertilizer On Some Characteristics Of Two Cultivars Of Barley Hordeum Vulgare.L

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Abstract

A field experiment was carried out in the winter season (2020-2021) in the Al Bulatif area - Muthanna governorate using a randomized complete block design with three replications in order to know the effect of the biological inoculum on some vegetative traits on the growth and yield of two cultivars of barley (Hordeum vulgare L.) variety (Buraq and Ibaa 99) and through the results of the statistical analysis, it was found that the addition of the bio-bacterial inoculum was superior to the comparison treatment and it gave significant differences in most of the studied traits, and the highest percentage of increase was in most of the studied characters of barley plant (number of branches, plant height, leaf area, grain yield , the weight of one thousand grains) and the average traits were (5.297 branches.m-2, 101.35 cm, 16.075 cm2, 53.42 g, 3.015 tons.ha-1) respectively compared to the control treatment (not adding the biological inoculum).

Keyword: bacterial fertilizer, Hordeum vulgare.L, vegetative characteristics

Introduction

The barley crop is one of the strategic crops, as it ranks fourth after wheat, maize and rice in terms of area and production (it is the second crop after wheat among the grain crops in Iraq in terms of area and production) as the economic importance of barley is concentrated in its use as a feed material for animals, Its cultivation succeeds in the rainy and irrigated areas of Iraq, and the barley crop is one of the crops that is characterized by its good ability to tolerate salinity, especially in the regions of central and southern Iraq, that is, it is distinguished from wheat by its tolerance of drought and salinity (Al-Dulaimi, 2015).

The world has moved towards clean technologies while minimizing pollution, and the use of natural materials such as organic fertilizers and bio-fertilizers is a suitable alternative to chemical fertilizers (Al-Wahaibi, 2008). Bio-fertilizers are micro-organisms or a compatible group of micro-organisms that provide one or more nutrients necessary for plant growth by which all or part of the chemical fertilizers that contain the required element can be dispensed with (Al-Balkhi, 1990). The use of biological fertilizers has a very beneficial effect in increasing productivity in terms of quantity and quality at lower costs. The most important use of bio fertilizers is to improve the properties of the soil by decomposing tissues of animals and plants in it and integrating the liberated products and elements with the soil or

by collecting its granules with what they secrete from sugary substances, as well as the availability of biological fertilizers Part of the plant's macro nutrients such as N, P and K, which secrete some acids and hormones that act as plant growth regulators, as well as secrete some antibiotics, which helps to resist some endemic diseases in the soil, which benefits the plant and its growth in addition to its role in increasing production (Kumar, 2010). The mechanism of action of bio-fertilizers is based on changing the microbial content in the area surrounding the root (the rhizosphere) through inoculation of the soil or seeds or both with microorganisms isolated from their natural environments, and from agricultural environments and working on their development in the laboratory and then experimenting with agricultural soils for different types of Crops, the rhizosphere contains organisms that contribute significantly to the dissolution of elements related to clay minerals, which maintains the fertility of the soil and its natural components by supplying the soil with large numbers of beneficial organisms, which leads to the microbial change in the soil in favor of beneficial microbes (Youssef and Eissa, 2014 and Mazid and Khan, 2014). **Therefore, the experiment aimed to:**

1- Studying the effect of adding bacterial fertilizer on the growth and yield of barley and increasing the availability of nutrients in the soil

2- Studying the effect of different cultivars of barley on growth and yield.

3- Studying the overlapping effect of biological fertilization and barley cultivars on growth and yield.

Materials and methods

***Diagnosis of Pseudomonas and Bacillus**

The diagnosis included the study of the biochemical characteristics as well as the phenotypic and microscopic characteristics of isolates of Pseudomonas and Bacillus bacteria, taking into consideration the study of the traits that go back to the diagnosis of the genus and its species (Khammas et al, 1989; Tarrand et al, 1978; Holt et al, 1994; Krieg & Dobereiner, 1984).

*** Preparation of different concentrations of bacterial fertilizer**

Three concentrations of bacterial fertilizer (0.5, 1, 1.5) were prepared by adding 0.5 g of bacterial fertilizer to 95 ml of distilled water, and the same method was followed with the other concentrations. The concentrations were placed in 250 ml flasks and kept at a temperature of -4 °C. Until use in subsequent experiments.

*** Steps to implement the field experiment**

Preparing the land: The land was prepared in terms of plowing, smoothing, leveling and dividing it into plates of dimensions (2 * 2) m^2, and these plates were separated by shoulders, their width was 0.75 m^2 to prevent pollution from occurring during irrigation.

Addition of bio-fertilizer: three concentrations of bacterial bio-fertilizer were used in the experiments, which represent (0.5, 1, 1.5)%, where 0.5 kg of seeds for two types of barley (Buraq and Ibaa 99) were contaminated with 1 liter of bacterial suspension and three replicates for each concentration. The seeds were left inside the bacterial suspension for two hours before being used in cultivation

The following vegetative characteristics were studied:

1- Number of branches of the plant: Five plants were taken at random from each experimental unit in the harvest phase and the number of the following branches was calculated (the components of the yield):
2- 2- Plant height.cm^{-1} :Five plants were randomly selected from each experimental unit.
3- The weight of 1000 grains: taken at random from the grain yield for each experimental unit.
4- Grain yield, kg^{-1}.: It was calculated on the basis of the square meter of the median lines of each experimental unit, and the yield was adjusted on the basis of 14% moisture (Briggs & Ytinfisu, 1980).
5- Leaf area cm^2: It was calculated from five plants taken randomly according to Thomas' equation (1975).

Paper area = length of paper x width in the middle x correction factor (0.95).

Statistical Analysis:

The data were statistically analyzed using Genstat program, version. The means were compared using the least significant difference (L.S.D) at the 0.05 level to know the nature of the differences between the treatments (Al-Rawi and Khalaf Allah, 2000).

Results

number of branches

The results (Table 1) showed a significant effect on the number of branches, where an increase in the total number of branches was observed. M^{-2} with an increase in the bacterial inoculum. The treatment (concentration of 1.5 kg/ha B4) of Buraq cultivar gave the highest average number of branches. M^{-2}. It reached 5,297 branches. M^{-2}, followed by the same treatment for cultivar Iba 99 without significant difference from the previous one (concentration of 1 kg/ha B3). We also note that all treatments were significantly superior to the comparison treatment, which gave an average number of branches amounted to 3.733 branch.$^{m-2}$. As for the treatments of varieties and overlap, no significant differences appeared between them.

Table (1) The effect of the biological vaccine and the cultivars and the interaction between them on the character of the number of branches

vaccine / cultivars	control B1	0.5 kg/ha B2	1 kg/ha B3	1.5 kg/ha B4	average
Buraq A1	**3.733**	**4.947**	**5.090**	**5.297**	**4.766**
Ibaa 99 A2	**4.333**	**4.550**	**4.967**	**5.200**	**4.762**
average	**4.033**	**4.748**	**5.028**	**5.248**	**4.764**
$LSD_{0.05}$	cultivars	vaccine	**interaction**		
	0.395	**0.51**	**0.883**		

plant height

Through the results (Table 2), no significant differences were observed between the studied barley cultivars. As for the effect of the bacterial vaccine on the plant height characteristic, the treatment (concentration of 1.5 kg/ha (B4) excelled by giving it the highest rate of plant height of 101.35 cm, followed by and without a significant difference For the two treatments (concentration 1 kg/ha (B3) and concentration of 0.5 kg/ha (B2), all treatments gave a significant difference from the control treatment, while the lowest average was in the control treatment (without adding) B1, in which the plant height reached 83.75 cm.

As for the interaction between barley cultivars and the bio-bacterial inoculum, the combination (1.5 B4 x Ibaa 99 A2) gave the highest mean plant height of 102.10 cm, followed by treatment (1.5 B4 x Buraq variety) giving it an average height of 100.60 cm, while These two treatments did not differ significantly among themselves and with other addition treatments, but they outperformed all comparison treatments.

Table (2) The effect of the biological vaccine and the cultivars **and the interaction between them on the character of the** plant height

vaccine / cultivars	control B1	0.5 kg/ha B2	1 kg/ha B3	1.5 kg/ha B4	average
Buraq A1	**79.00**	**95.30**	**100.10**	**100.60**	**93.75**
Ibaa 99 A2	**88.50**	**98.20**	**99.00**	**102.10**	**96.95**
average	**83.75**	**96.75**	**99.55**	**101.35**	**95.35**

$LSD_{0.05}$	cultivars	vaccine	**interaction**
	6.97	**9.00**	**15.59**

leaf area

The results of the statistical analysis in Table (3) showed the significant effect of the biological vaccine and the interaction on the characteristic of the leaf area of the barley crop, while the cultivars did not show any significant effect in this trait. The results (Table 3) showed that there were significant differences in the increase in leaf area when increasing the amount of bacterial inoculum. The treatment gave a concentration of 1.5 kg/ha of B4, the highest mean for the leaf area trait amounted to 16.075 cm2, followed by a treatment of 1.5 kg/ha of B4 concentration, which gave an average for the area of the trait. The leaf area was 15.115 cm2, while the rest of the treatments did not give significant differences in this trait compared to the comparison treatment (Buraq A1 x without adding B1), which gave the lowest average for this trait amounted to 13.665. cm2.

Table (3) The effect of the biological vaccine and the cultivars and the interaction between them on the character of The area leaf (cm2).

vaccine / cultivars	control B1	0.5 kg/ha B2	1 kg/ha B3	1.5 kg/ha B4	average
Buraq A1	**12.650**	**16.210**	**14.730**	**16.580**	**15.042**
Ibaa 99 A2	**14.680**	**15.900**	**15.500**	**15.570**	**15.412**
average	**13.665**	**16.055**	**15.115**	**16.075**	**15.227**
$LSD_{0.05}$	cultivars	vaccine	**interaction**		
	1.691	**2.182**	**3.78**		

Weight of 1000 grains

The results showed (Table 4) the moral effect of the cultivars on the trait of weight of a thousand grains, as Buraq cultivar recorded the highest average of 50.44 g with a significant difference from the other cultivars, followed by Ibaa 99 with an average of 48.70 g.

It also showed that there was a significant difference in the trait of 1000 grains when using the bacterial vaccine, as the treatment (1.5 kg/ha B4) recorded the highest average amounting to 53.42 g with a significant difference from the rest of the treatments, then two

treatments (1 kg/ha B3 and 0.5 kg/ha B2) with averages of 51.43 and 49.28 g, respectively, compared to the comparison equation, which gave the lowest average of 44.17 g.

There was a significant interaction between the two experimental factors in the same trait, as the combination (Buraq x 1.5 kg/ha B4) recorded the highest average weight of one thousand grains amounted to 54.09 g, followed by the combination (Buraq x 1 kg/ha B3) with an average of 52.75 g While the mixture (cultivar Ibaa 99 x without adding B1) recorded the lowest average for this trait amounting to 43.26 g.

Table (4) The effect of the biological vaccine and the cultivars and the interaction between them on the character of a thousand grains (cm2).

vaccine / cultivars	control B1	0.5 kg/ha B2	1 kg/ha B3	1.5 kg/ha B4	average
Buraq A1	**45.08**	**50.19**	**52.43**	**54.09**	**50.44**
Ibaa 99 A2	**43.26**	**48.37**	**50.44**	**52.75**	**48.70**
average	**44.17**	**49.28**	**51.43**	**53.42**	**49.57**
$LSD_{0.05}$	cultivars	vaccine	**interaction**		
	0.906	**1.170**	**2.026**		

grain yield

The results of the statistical analysis indicated the significant effect of the bacterial vaccine and the interaction in the trait of grain yield ton.ha-1, while the cultivars had no significant differences in this trait.

The results showed that there were significant differences in the increase of grain yield ton.ha-1 with the increase in the amount of bacterial pollen, where the treatment (1.5 kg/ha) gave the highest mean of total grain yield of 3.015 $ton.ha^{-1}$ without significant difference from the treatment of 1 kg/ha. B3, which gave an average of 2.71 $tons.ha^{-1}$, while the rest of the treatments did not give significant differences from the comparison treatment without adding B1, which gave the lowest average for this trait amounted to 1.97 $tons.ha^{-1}$.

The results of the interaction between the cultivars and the amount of bacterial vaccine in the barley crop showed the superiority of the treatment (Ibaa 99 2A x 1.5 kg/ha B4) by giving it the highest mean of the grain yield, which amounted to 3.13 $tons.ha^{-1}$, followed by the two treatments (Buraq A1 x 1.5 kg/ha). 4B) and (Aba 99 A2 x 1 kg/ha B3) by giving them average grain yield, which were 2.90 and 2.76 $tons.ha^{-1}$, compared with the control

treatment (Buraq A1 x without adding B1), which gave the lowest average grain yield of 1.81 tons.ha^{-1}.

Table (5) The effect of the biological vaccine and the cultivars and the interaction between them on the character of grain yield (cm2).

vaccine / cultivars	control B1	0.5 kg/ha B2	1 kg/ha B3	1.5 kg/ha B4	average
Buraq A1	**1.81**	**2.09**	**2.67**	**2.90**	**2.36**
Ibaa 99 A2	**2.13**	**2.62**	**2.76**	**3.13**	**2.66**
average	**1.97**	**2.35**	**2.71**	**3.01**	**2.51**
$LSD_{0.05}$	cultivars	vaccine	**interaction**		
	0.52	**0.67**	**1.16**		

Discussion

The moral superiority in the characteristic of the number of branches may be due to the increase in the total number of branches per unit area to the increase in the amount of nitrogen fertilizer on the basis that the superior treatment provided nitrogen in the required quantity in the early stages of growth, which encouraged the growth of roots that have a positive relationship with the formation of the branches and also supported The growth of the buds of the buds and the prolongation of their production period, which increased the emergence of the primary and secondary buds, and these results are consistent with what was stated by Al-Jabri (2020) and Al-Barakat (2016).

As for the height of the plant, it may be due to the difference in its content of the hormone gibberellin and auxin, which are responsible for the elongation and expansion of cells, which affects the height of the plant. Treating him with bacteria This result agreed with Al-Shammari (2018).

The reason for the increase in the average leaf area in barley plant may be due to improving metabolic processes and encouraging the absorption of nutrients, especially nitrogen and phosphorous, It contributes to improving plant growth and functional performance, and this is reflected positively by increasing the leaf crushing of barley plants this is identical to what was mentioned by Al-Ziyadi (2020).

Al-Salem (2018) mentioned that the differences among the varieties in the characteristics of the weight of a thousand grains, and the positive role of the bio-bacterial vaccine can be attributed to the role played by the microorganisms used in providing the nutritional needs,

especially for the elements nitrogen and phosphorous, and then the increase in the weight of the seeds, this is what he indicated. Noni, 2016), All varieties recorded the highest average weight of a thousand grains with the levels of fertilization used in the experiment, and this is normal, which explains all the results of this trait, whether under the single influence of factors or the effect of interference, because the relationship between the components of the yield in small grain crops is governed by the principle of compensation (Farooq et al. , 2018)

That is, the components cannot increase together under the influence of any treatment. Therefore, what explains the increase in the weight of the thousand grains of the Buraq variety and the biological vaccine and the above combination is that it recorded the lowest averages in the number of fertile spikes and the number of grains in the spike, which prompted it to compensate for the increase in the weight of the thousand grains and this is due to the lack of The number of grains in the spike, and consequently, the lack of competition between the grains for the materials they export, which led to the accumulation of a larger dry matter that caused an increase in the weight of the grain, which was reflected in the increase in the weight of a thousand grains. Poureidi et al. (2015).

The reason may be due to a significant presence in the grain yield due to the increase in nitrogen content in the plant, which may increase the vital processes, as a result of increasing its absorption. It is one of the components of enzymes and proteins, and it is included in all processes, enzymatic reactions, and photosynthesis.), and this is what was obtained by (Amal and Farag et al. 2012) with barley and Tahir (2016) with wheat.

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